

**PCDC - Pressure Case Directional**  
**PCGK - Pressure Case Gamma**

**1 : 240**

Country : <b>USA</b>			
Field : <b>Wattenberg</b>			
Location : <b>Lat: 40° 43' 48.50" North</b> <b>Long: 103° 57' 10.55" West</b>			
Well : <b>Castor Federal LC23-62HN</b>			
Company : <b>Noble Energy</b>			
Rig : <b>H&amp;P 322</b>			
LOCATION			
Latitude : <b>40° 43' 48.50" North</b> Longitude : <b>103° 57' 10.55" West</b>		Other Services <b>Directional Drilling</b>	
UTM Easting = 3428754.752ft UTM Northing = 1512574.211 ft			
Company : <b>Noble Energy</b>		: <b>Noble Energy</b>	
Rig : <b>H&amp;P 322</b>		: <b>H&amp;P 322</b>	
Well : <b>Castor Federal LC23-62HN</b>		: <b>Castor Federal LC23-62HN</b>	
Field : <b>Wattenberg</b>		: <b>Wattenberg</b>	
Country : <b>USA</b>		: <b>USA</b>	
API Number : <b>05-123-36392</b>			
Permanent Datum : <b>Ground Level</b>		Elevation : <b>4847.00 ft</b>	
Log Measured From : <b>Drill Floor</b>		24.00 ft Above Permanent Datum	
Drilling Measured From : <b>Drill Floor</b>		<b>MD LOG</b>	
Depth Logged : <b>682.00 ft</b> To <b>10,278.00 ft</b>		Unit No. : <b>11210425</b>	
Date Logged : <b>14-Jan-13</b> To <b>19-Jan-13</b>		Job No. : <b>CA-XX-0900071989</b>	
Total Depth MD : <b>10,278.00 ft</b> TVD : <b>5,994.25 ft</b>		Plot Type : <b>Final</b>	
Spud Date : <b>13-Jan-13</b>		Plot Date : <b>20-Jan-13</b>	
Run No.		Run No.	
Size		Size	
From		From	
To		To	
8.750 in		5,300.00 ft	
2		8.750 in	
3		5,300.00 ft	
4		6,443.00 ft	
6.125 in		10278.00 ft	
Borehole Record (MD)		Borehole Record (MD)	
Size		Size	
From		From	
To		To	
9.625 in		36.00 lbpf	
7.000 in		24.00 lbpf	
Casing Record (MD)		Casing Record (MD)	
Size		Size	
From		From	
To		To	
672.00 ft		SURFACE	
6,433.00 ft		SURFACE	

**WELL INFORMATION**

MWD Run Number	100	200	300		
Date run completed	15-Jan-13	16-Jan-13	20-Jan-13		
Rig Bit Number	2	3	4		
Bit Size (in)	8.750	8.750	6.125		
Tool Nominal OD (in)	6.750	8.000	4.750		
Log Start Depth (MD, ft)	682.00	5,300.00	6,443.00		
Log End Depth (MD, ft)	5,300.00	6,443.00	10,278.00		
Drill or Wipe	Drill	Drill	Drill		
Drill/Wipe Start Date and Time	14-Jan-13 21:30	15-Jan-13 18:00	17-Jan-13 10:36		
Drill/Wipe End Date and Time	15-Jan-13 10:21	16-Jan-13 06:04	19-Jan-13 15:06		
Min Inc (deg) @ Depth (MD, ft)	.17 @ 4,511.00	1.59 @ 5,358.00	86.30 @ 6,469.00		
Max Inc (deg) @ Depth (MD, ft)	16.54 @ 2,803.00	81.16 @ 6,387.00	94.19 @ 10,212.00		
Bit TFA(in2) / Bit Type	.75 / PDC	.86 / PDC	.46 / PDC		
Flow Rate (gpm)	592.00	577.00	270.00		
Max AV (fpm) / CV (fpm) @ MWD	473.2 / 473.2	473.2 / 473.2	436.9 / 436.9		
Fluid Type	Fresh Water Gel	Fresh Water Gel	Fresh Water Gel		
Density (ppg) / Viscosity (spqt)	8.60 / 27.00	8.60 / 27.00	9.95 / 37.00		
Filtrate CL (ppm)	650.00	650.00	700.00		
pH / Fluid Loss (mptm)	8.20 / N/A	8.20 / N/A	8.00 / N/A		
PV (cP) / YP (lbf2)	1 / 3.00	1 / 3.00	9 / 12.00		
% Solids / % Sand	0.4 / .10	0.40 / 0.10	7.5 / .35		
% Oil / Oil:Water Ratio	N/A / N/A	N/A / N/A	N/A / N/A		
Rm @ Measured Temp (degF)	N/A @ N/A	N/A @ N/A	N/A @ N/A		
Rmf @ Measured Temp (degF)	N/A @ N/A	N/A @ N/A	N/A @ N/A		
Rmc @ Measured Temp (degF)	N/A @ N/A	N/A @ N/A	N/A @ N/A		

Max Tool Temp (degF) / Source	133.30 / PCM	154.30 / PCM	209.20 / PCM		
Rm @ Max Tool Temp (degF)	N/A @ N/A	N/A @ N/A	N/A @ N/A		
Lead MWD Engineer	Osahon Igunbor	Osahon Igunbor	Osahon Igunbor		
Customer Representative	Jeremy Stolz	Jeremy Stolz	Charles Collver		

## SENSOR INFORMATION

### Downhole Processor Information

Tool Type	PCM	PCM	PCM		
Software Version	5.76	5.76	5.76		
Sub Serial Number	11341341	11341341	11341341		
Insert Serial Number	11680785	11680785	11680785		
Date and Time Initialized	13-Jan-13 20:28	13-Jan-13 20:28	16-Jan-13 20:42		
Date and Time Read	16-Jan-13 13:07	16-Jan-13 13:01	20-Jan-13 00:23		
ECMB SW Version	N/A	N/A	N/A		

### Directional Sensor Information

Tool Type	PCDC	PCDC	PCDC		
Distance From Bit (ft)	57.00	56.00	66.00		
Software Version	6.21	6.21	6.21		
Sub Serial Number	11341341	11341341	11341341		
Sonde Serial Number	11833258	11833258	11833258		
Sensor ID Number	N/A	N/A	N/A		
Toolface Offset (deg)	312.76	249.11	345.25		

### Gamma Ray Sensor Information

Tool Type	PCG	PCG	PCG		
Distance From Bit (ft)	49.95	49.08	59.28		
Recorded Sample Period (sec)	10	10	10		
Software Version	8.15	8.15	8.15		
Sub Serial Number	11341341	11341341	11341341		
Insert/Sonde Serial Number	11293280	11293280	11293280		

## REMARKS

1. All depths are measured depths and are calibrated to the driller' pipe tally and are measured from the drill floor.
2. No depth corrections have been made for pipe stretch or compression.
3. All data presented is recorded (memory data) unless otherwise stated.
4. The Following smoothing parameters have been applied to the data"

PGXC (Gamma CG Corrected):  
Interval Resolution: 0.5 feet  
Coercion Distance: 0.6 feet  
Gap Fill: 3.0 feet

ROPA (Rate of Penetration):  
Interval Resolution: 0.5 feet  
Coercion Distance: 1.2 feet

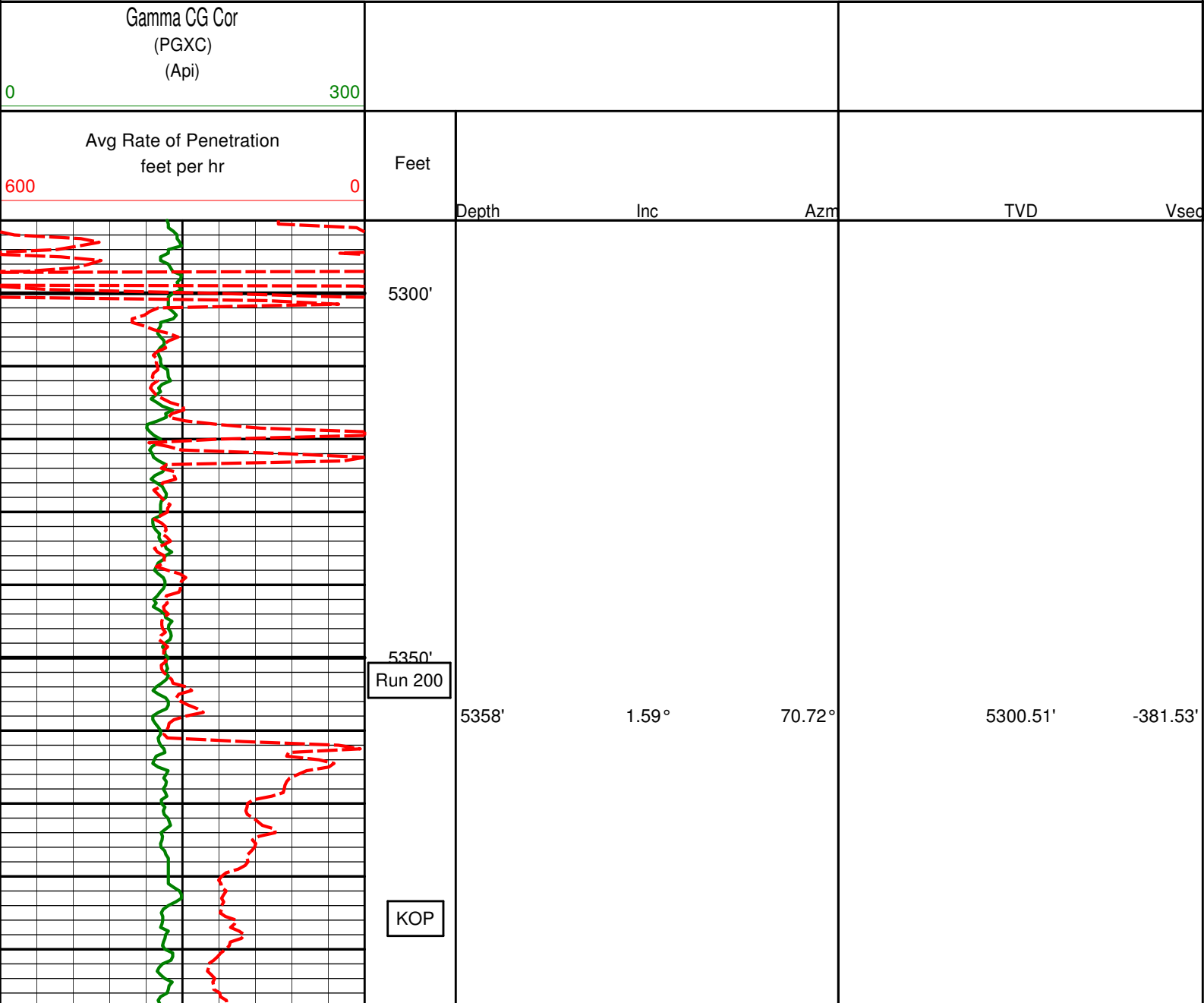
## WARRANTY

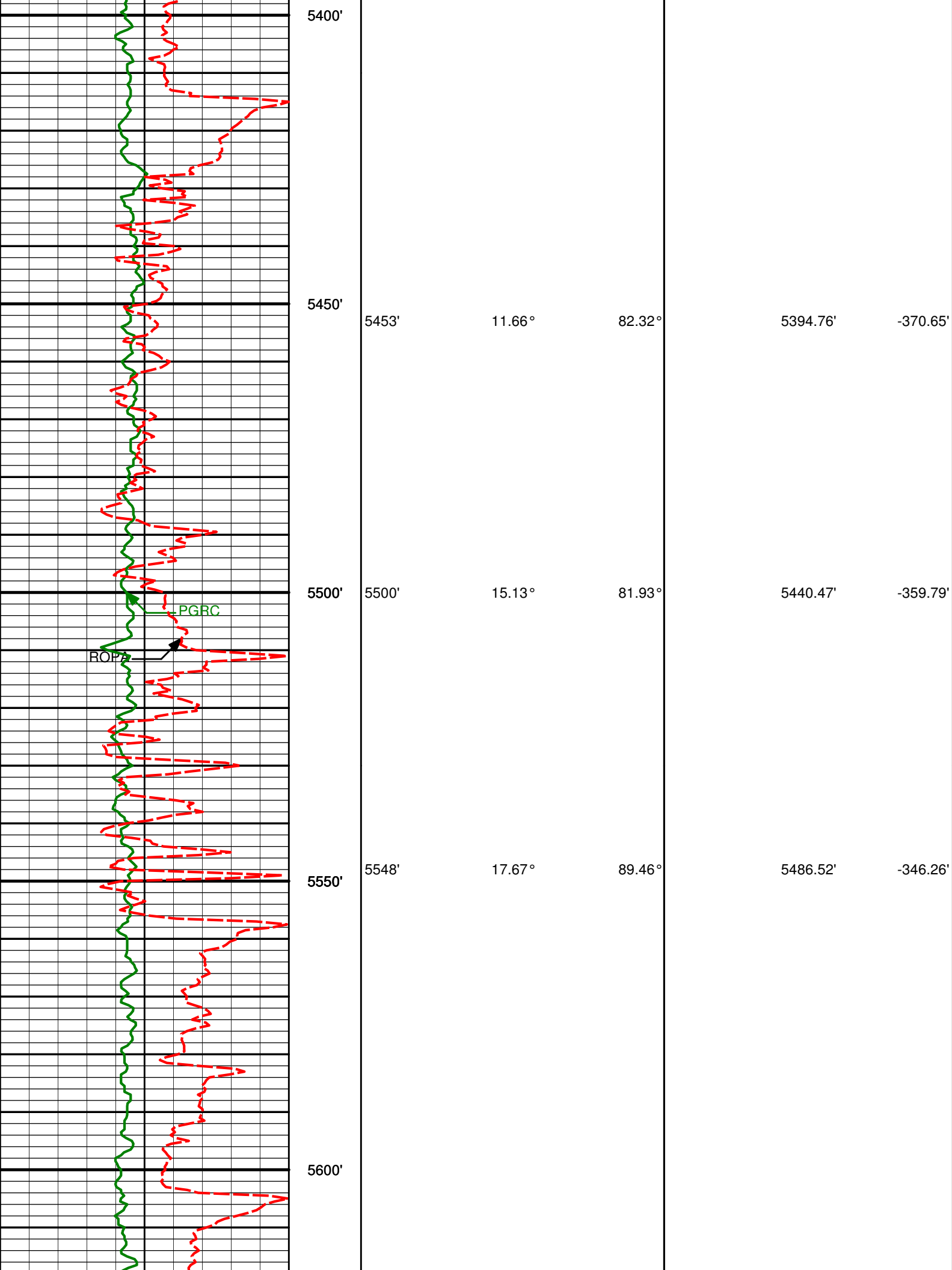
HALLIBURTON WILL USE ITS BEST EFFORTS TO FURNISH CUSTOMERS WITH ACCURATE INFORMATION AND INTERPRETATIONS

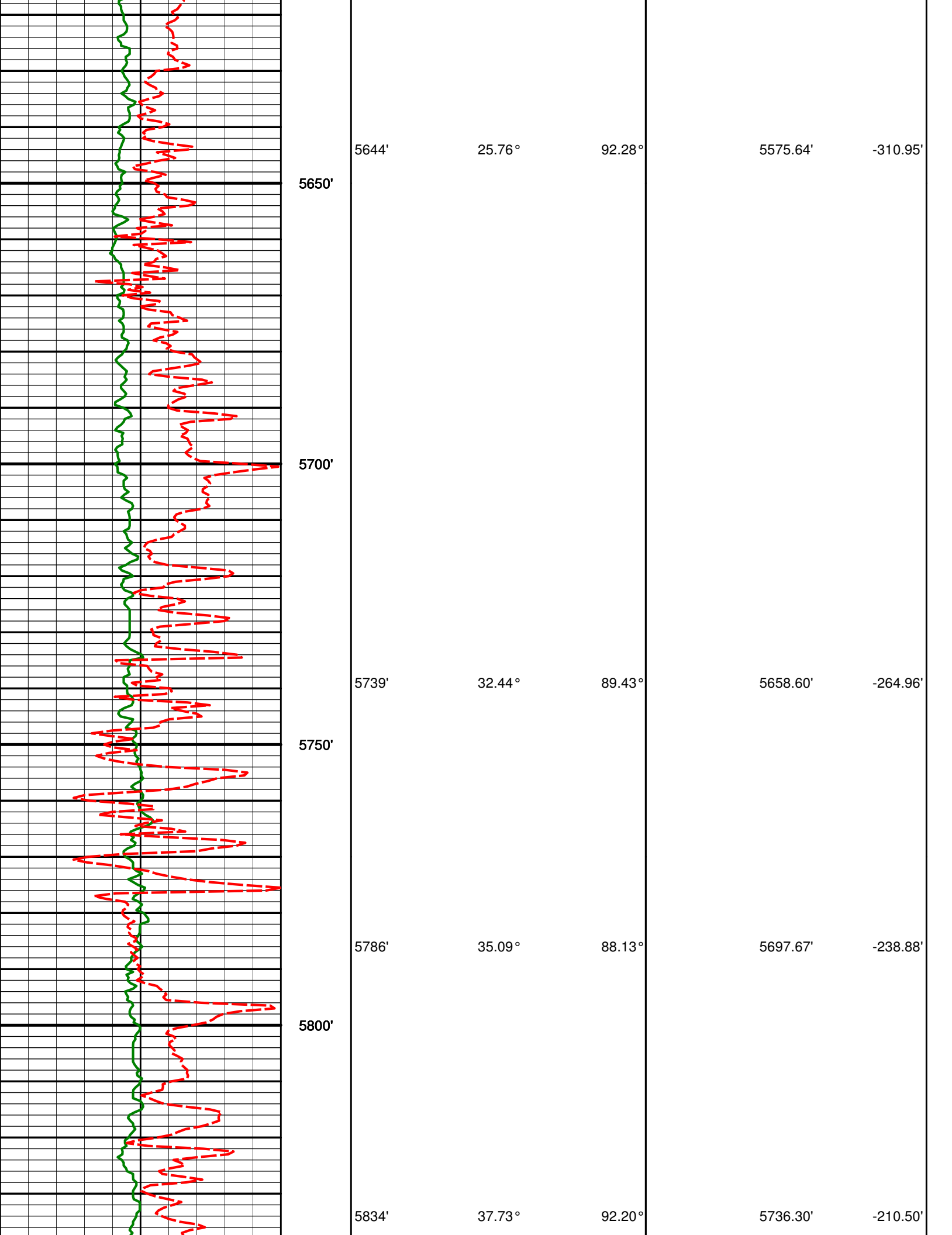
THAT ARE PART OF, AND INCIDENT TO, THE SERVICES PROVIDED. HOWEVER, HALLIBURTON CANNOT AND DOES NOT WARRANT THE ACCURACY OR CORRECTNESS OF SUCH INFORMATION AND INTERPRETATIONS. UNDER NO CIRCUMSTANCES SHOULD ANY SUCH INFORMATION OR INTERPRETATION BE RELIED UPON AS THE SOLE BASIS FOR ANY DRILLING, COMPLETION, PRODUCTION, OR FINANCIAL DECISION OR ANY PROCEDURE INVOLVING ANY RISK TO THE SAFETY OF ANY DRILLING VENTURE, DRILLING RIG OR ITS CREW OR ANY OTHER THIRD PARTY. THE CUSTOMER HAS FULL RESPONSIBILITY FOR ALL DRILLING, COMPLETION AND PRODUCTION OPERATION. HALLIBURTON MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WITH RESPECT TO THE SERVICES RENDERED. IN NO EVENT WILL HALLIBURTON BE LIABLE FOR FAILURE TO OBTAIN ANY PARTICULAR RESULTS OR FOR ANY DAMAGES, INCLUDING, BUT NOT LIMITED TO, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES, RESULTING FROM THE USE OF ANY INFORMATION OR INTERPRETATION PROVIDED BY HALLIBURTON.

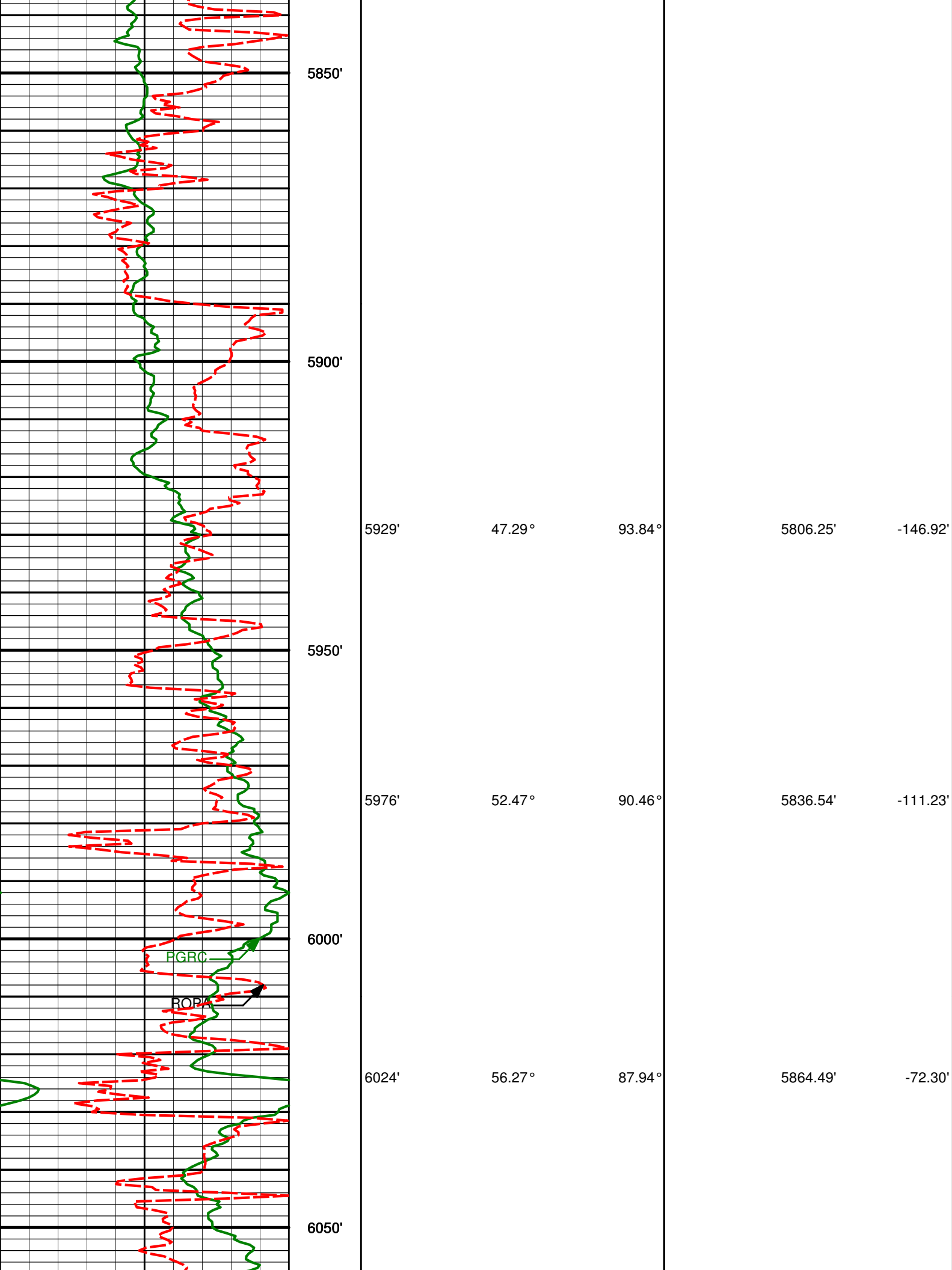
HALLIBURTON

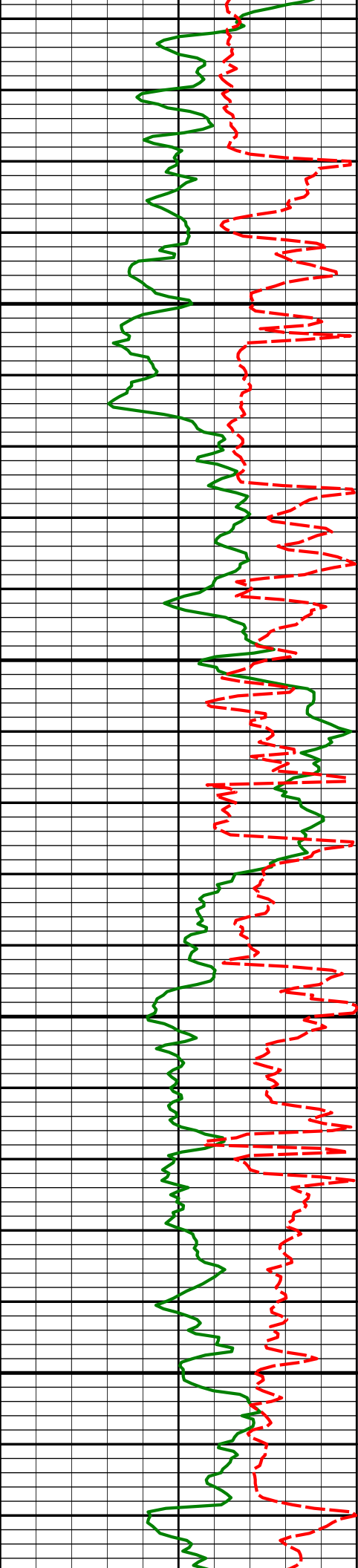
MD Detail Log 1:240



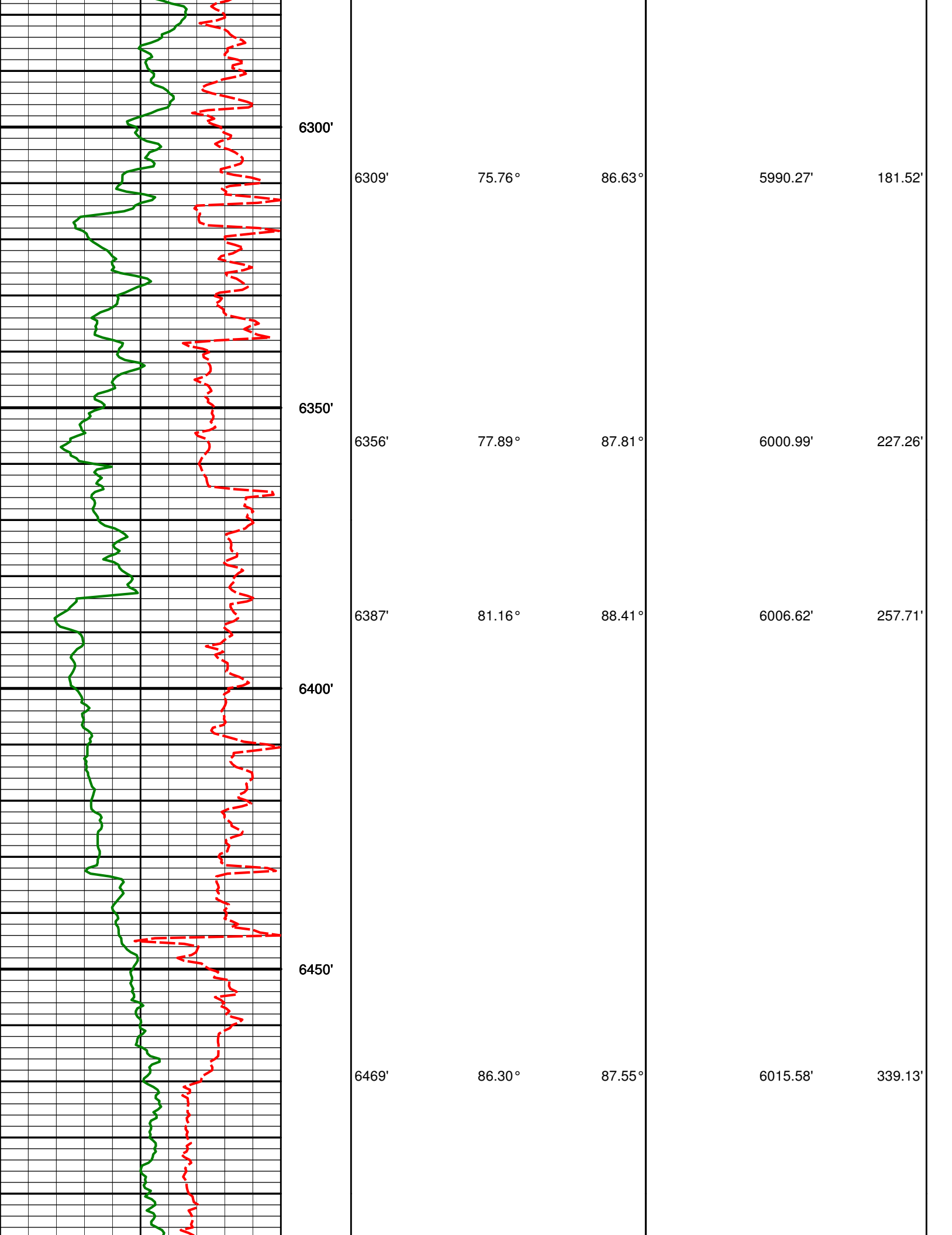


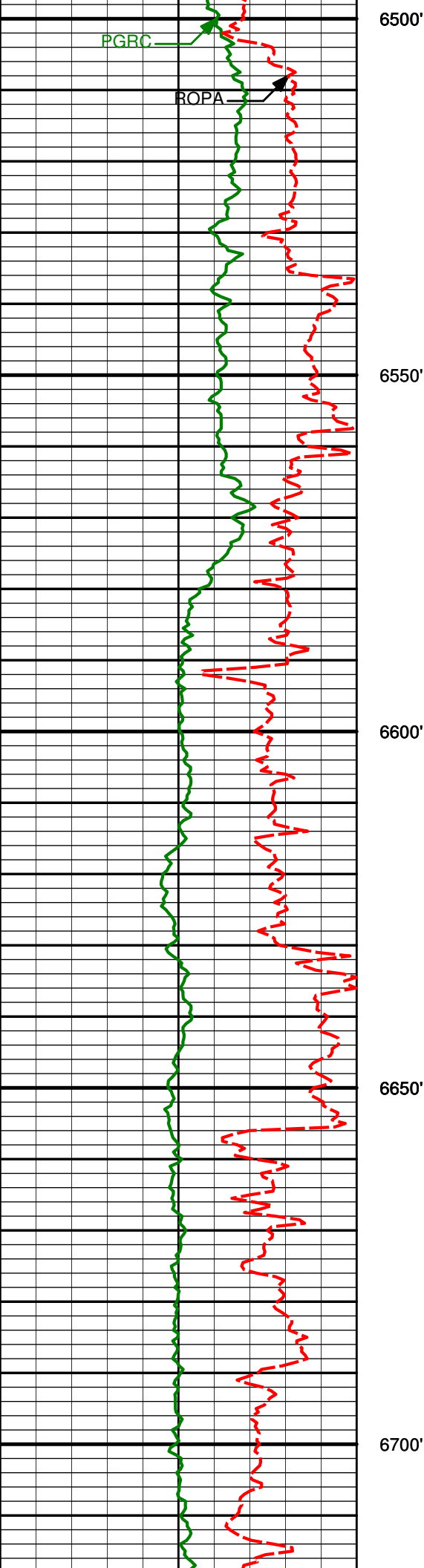






6071'	56.94°	89.16°	5890.36'	-33.11'
6100'				
6119'	59.95°	88.91°	5915.48'	7.72'
6150'				
6166'	62.54°	89.90°	5938.09'	48.83'
6200'				
6214'	65.75°	87.30°	5959.02'	91.95'
6250'				
6261'	70.73°	86.79°	5976.44'	135.58'





6564'

86.33°

89.00°

6021.69'

433.83'

6600'

6650'

6659'

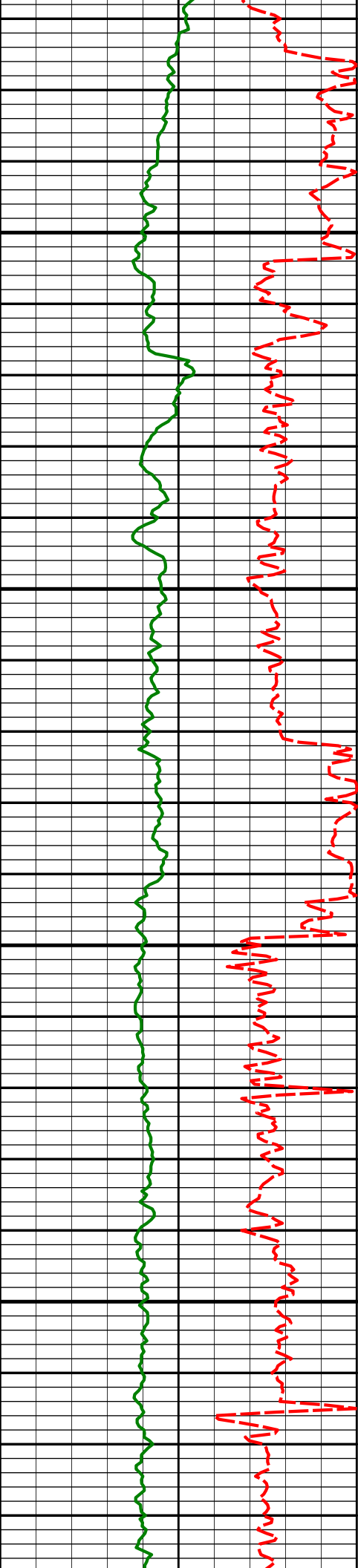
87.29°

90.36°

6026.98'

528.44'

6700'



6750'

6753'

88.70°

90.35°

6030.27'

622.07'

6800'

6850'

6848'

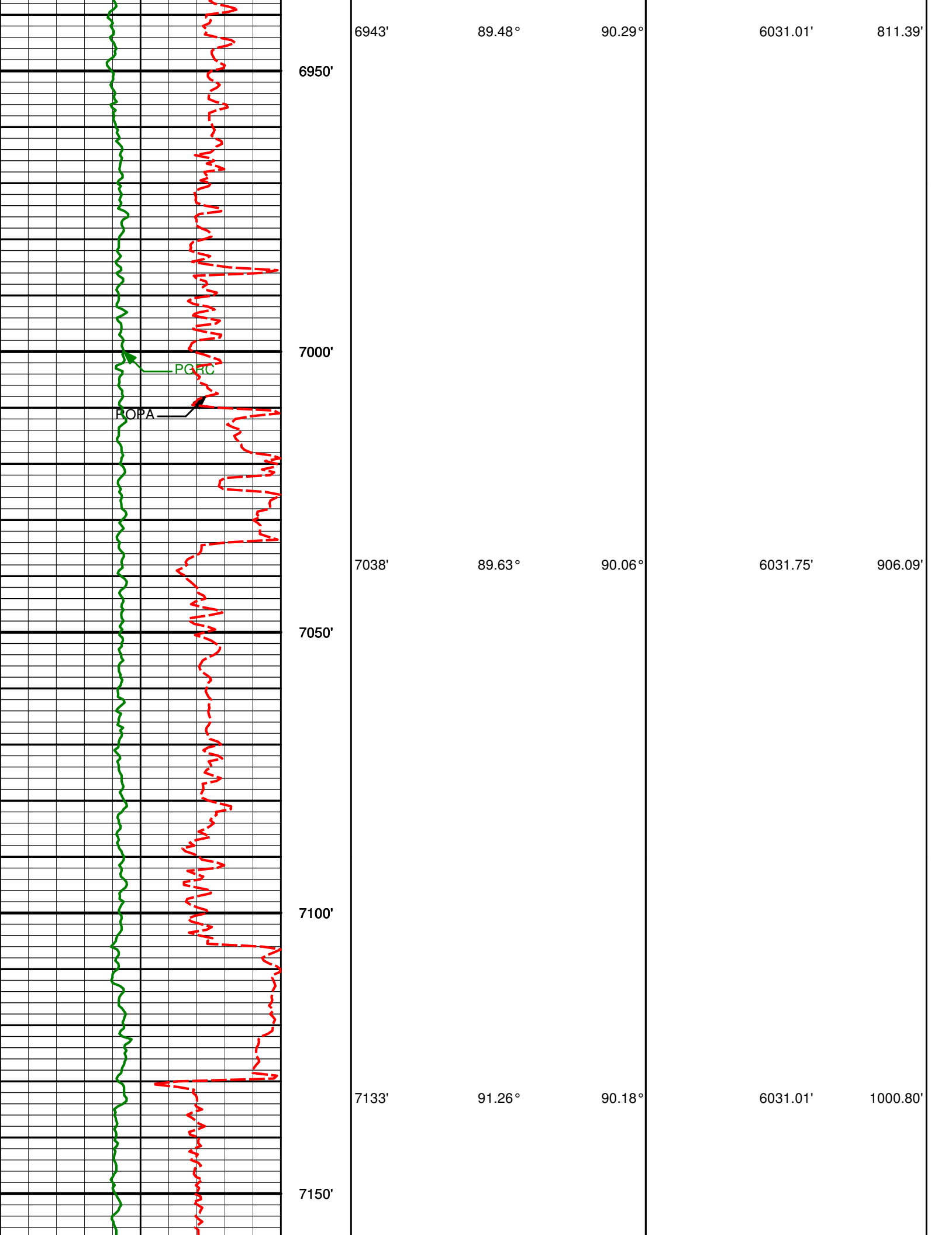
90.46°

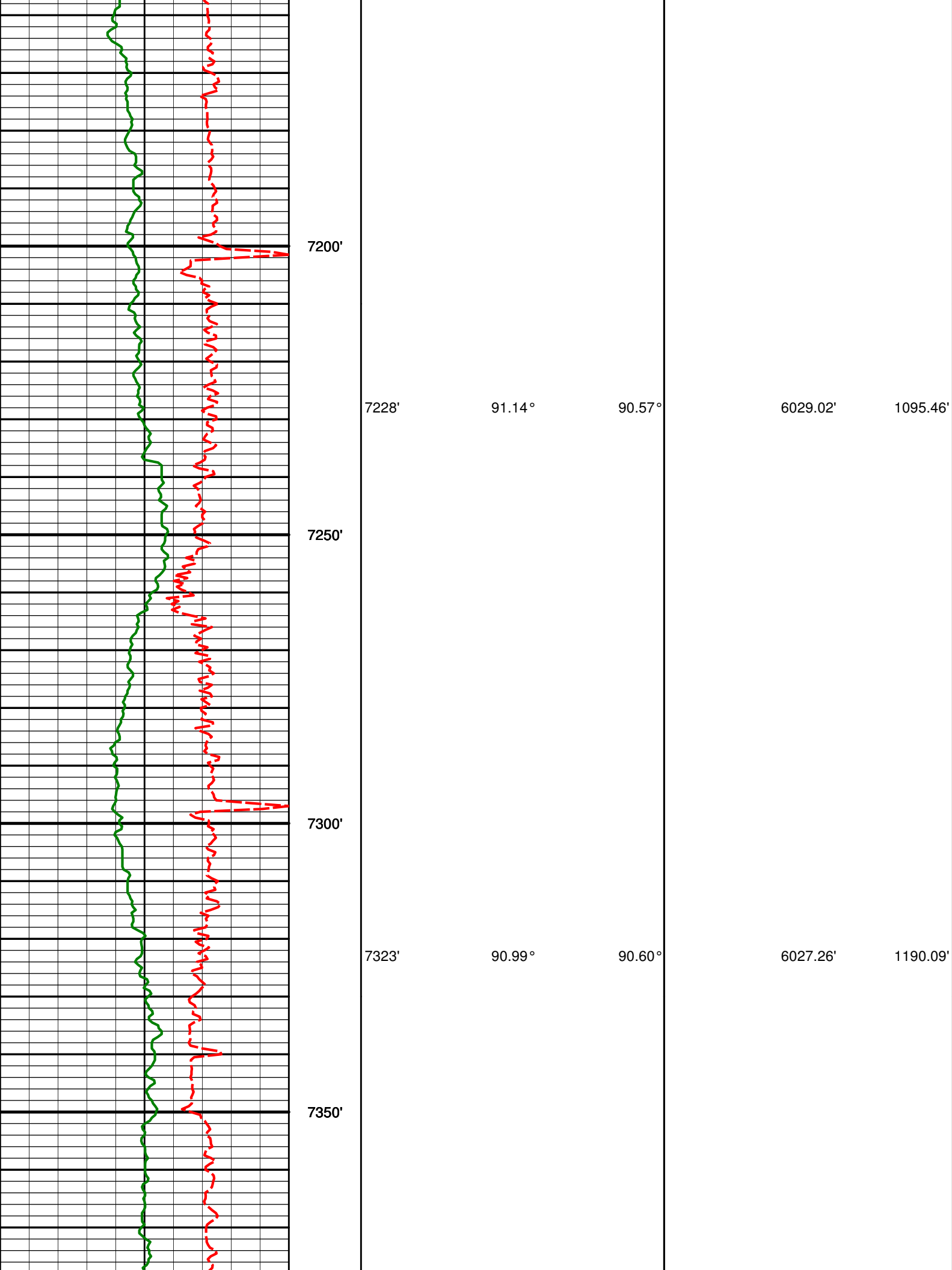
90.62°

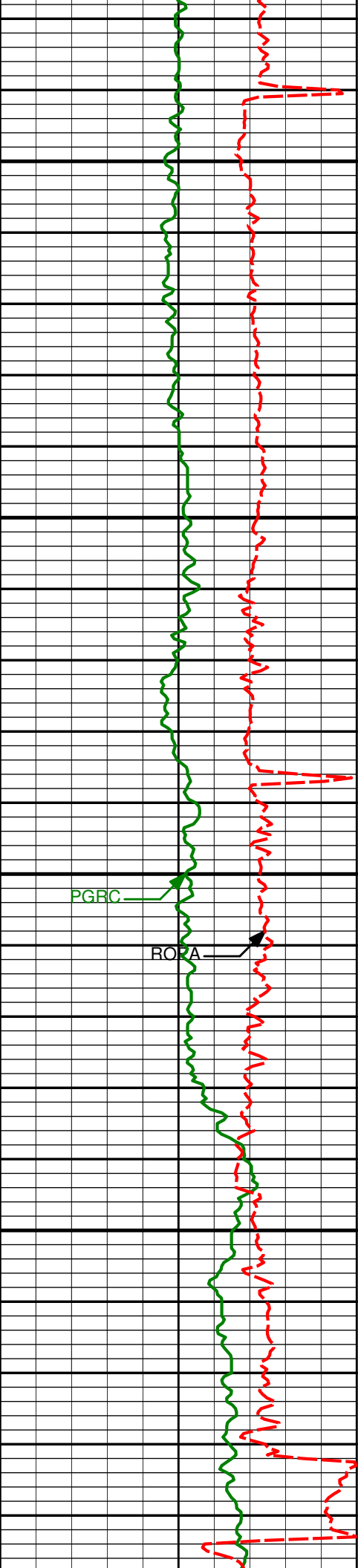
6030.96'

716.73'

6900'







7400'

7419'

91.02°

90.33°

6025.58'

1285.74'

7450'

7500'

PGRC

ROA

7513'

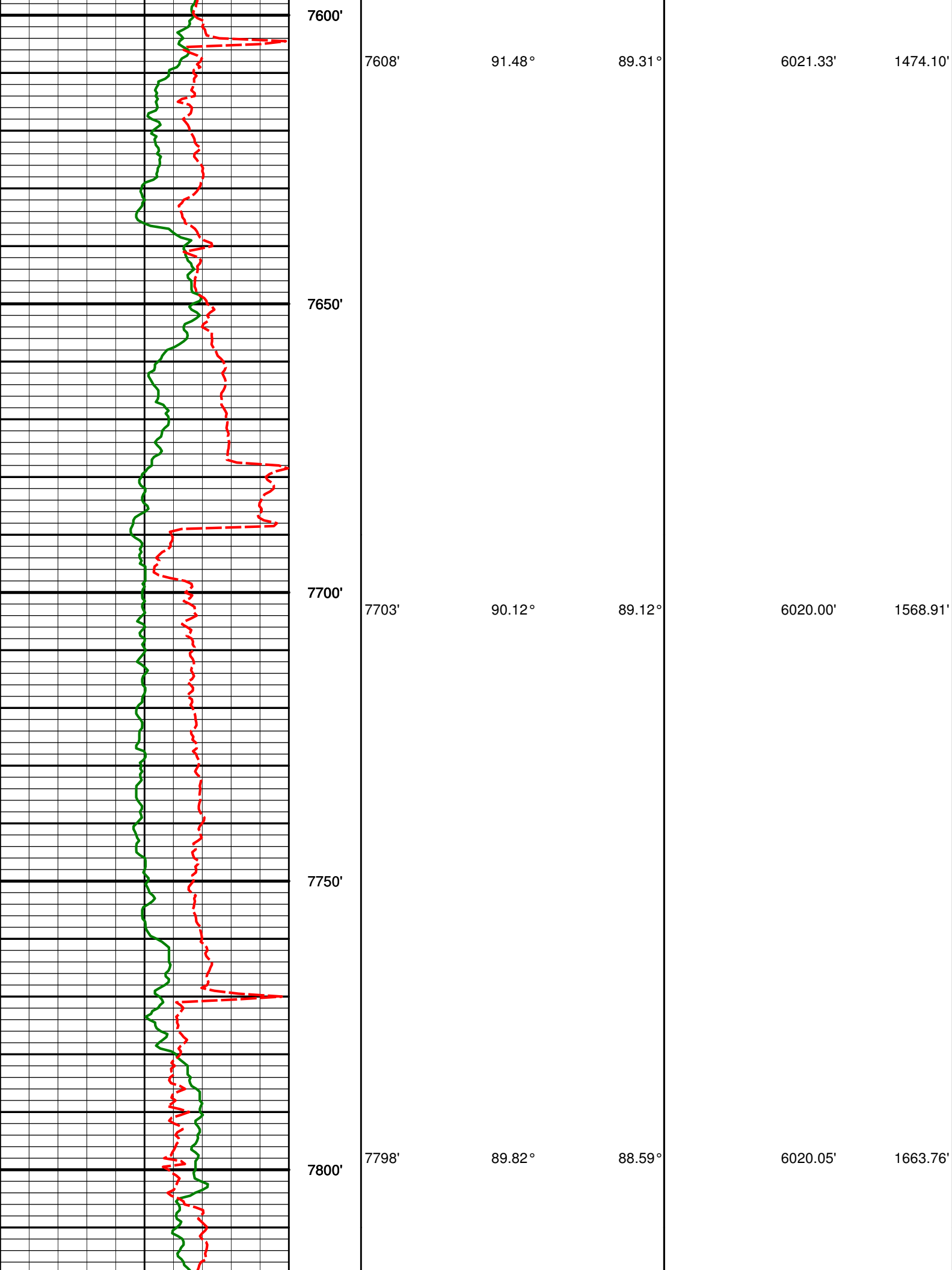
91.33°

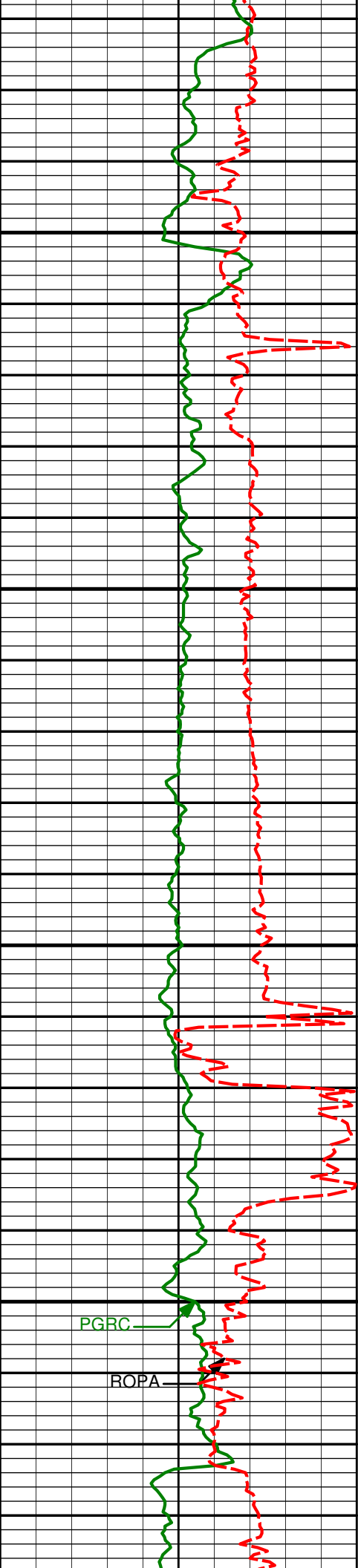
90.51°

6023.66'

1379.40'

7550'





7850'

7900'

7950'

8000'

7893'

7988'

89.97°

90.06°

87.67°

86.99°

6020.23'

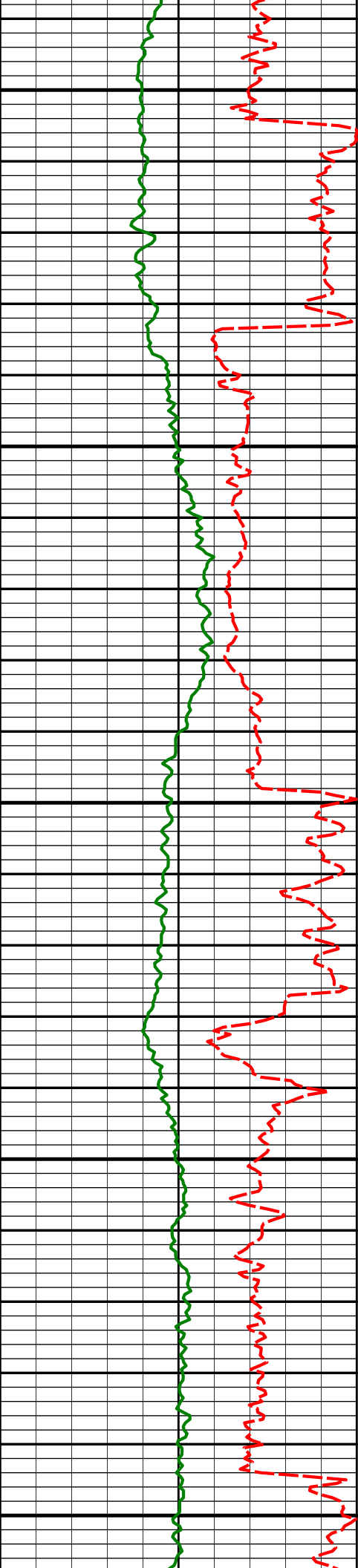
6020.21'

1758.67'

1853.63'

PGRC

ROPA



8050'

8083'

8100'

8150'

8178'

8200'

8250'

89.72°

88.03°

6020.38'

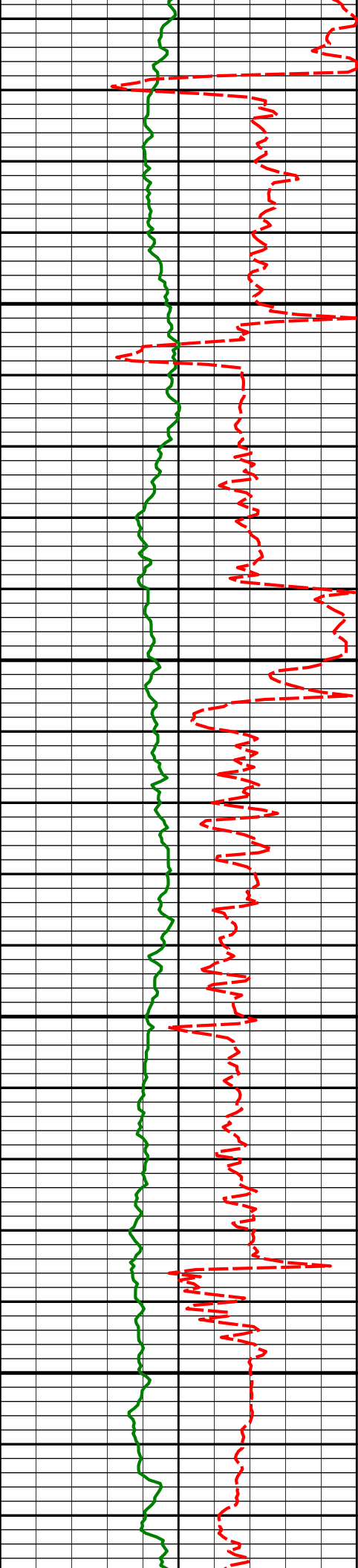
1948.58'

88.74°

89.22°

6021.66'

2043.44'



8273'

88.92°

91.72°

6023.61'

2138.08'

8300'

8350'

8368'

89.85°

91.54°

6024.63'

2232.56'

8400'

8450'

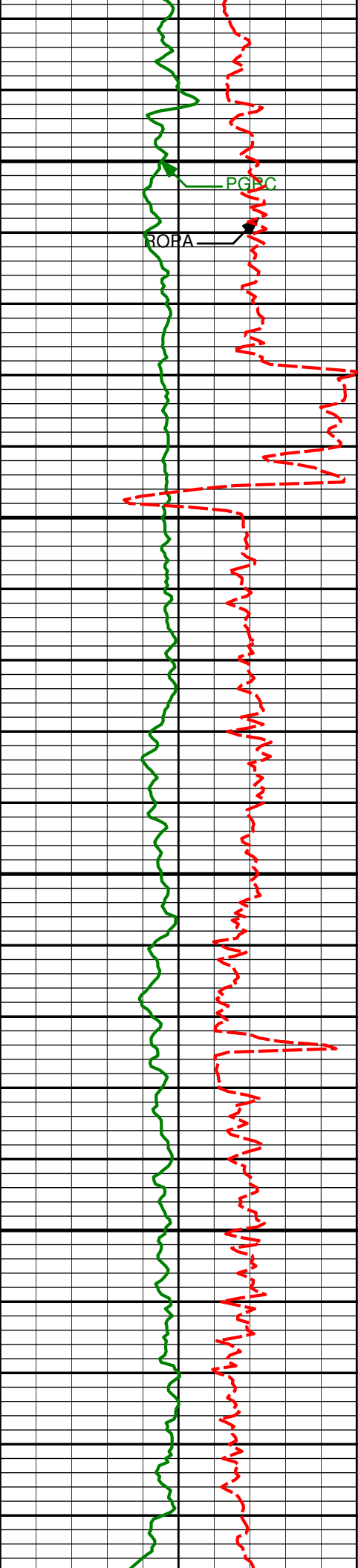
8462'

90.89°

92.67°

6024.02'

2325.96'



8500'

PG 10C

ROFA

8550'

8557'

89.88°

90.58°

6023.38'

2420.44'

8600'

8650'

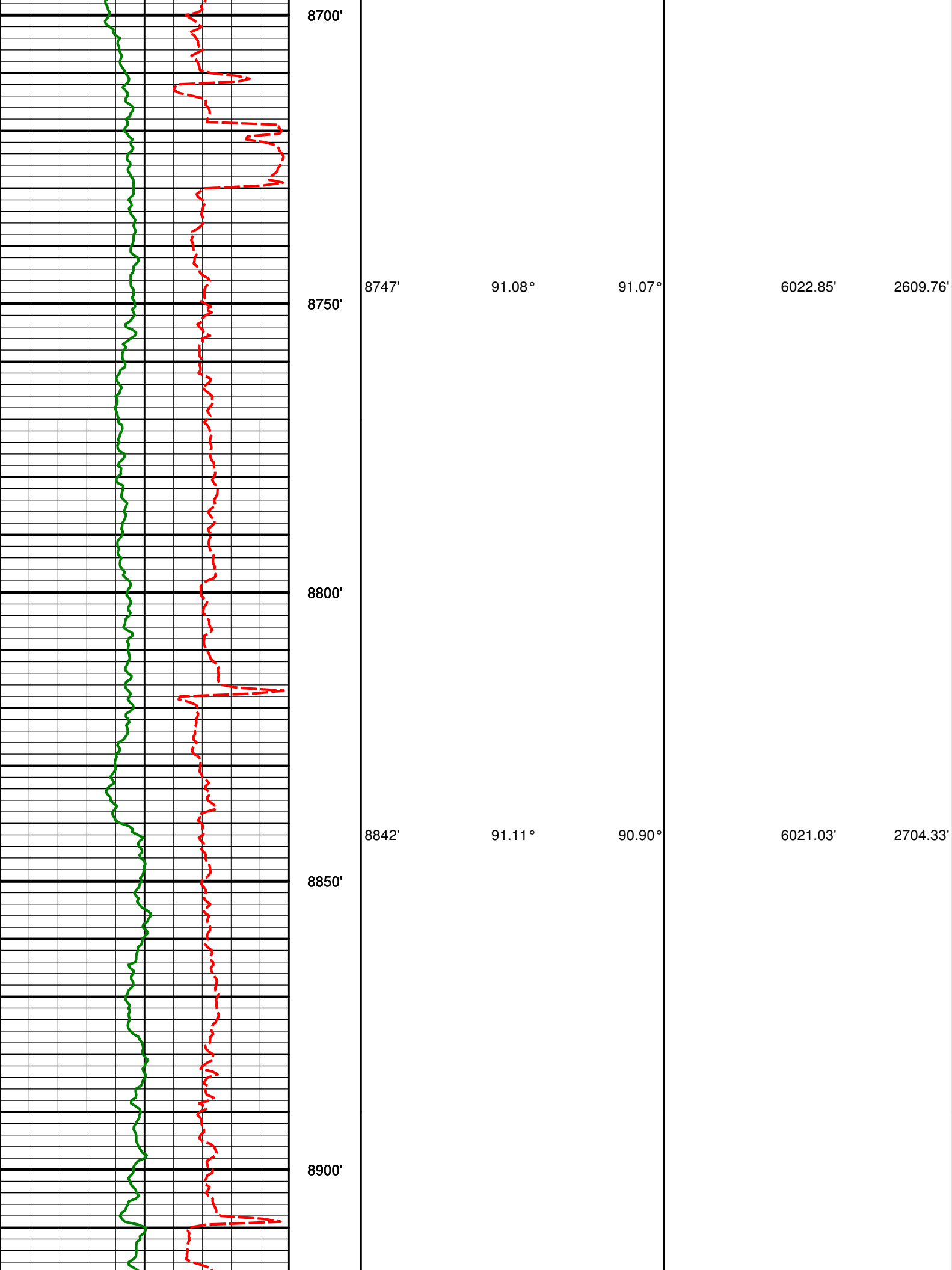
8652'

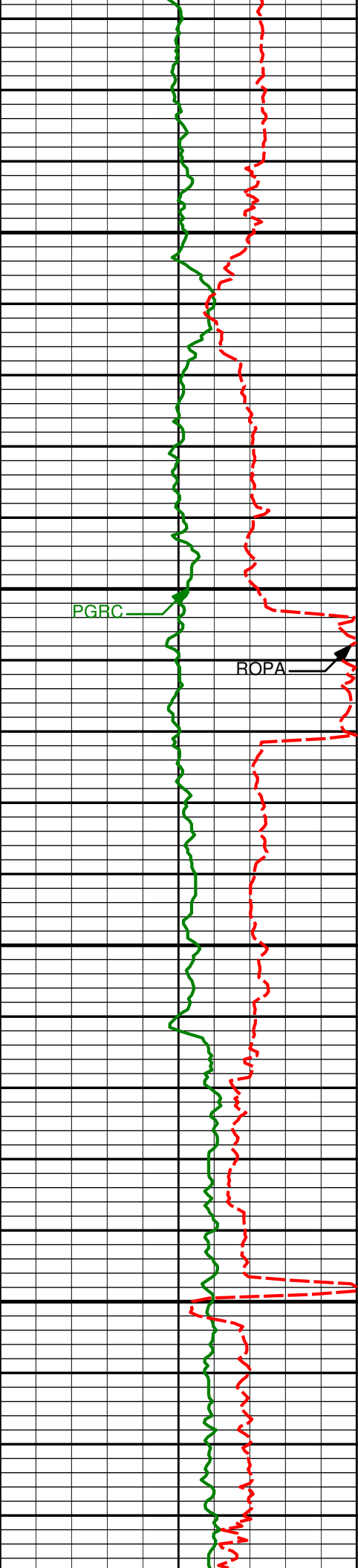
89.85°

90.12°

6023.61'

2515.12'





8937'

91.79°

91.33°

6018.63'

2798.87'

8950'

9000'

PGRC

ROPA

9032'

90.59°

89.40°

6016.66'

2893.52'

9050'

9100'

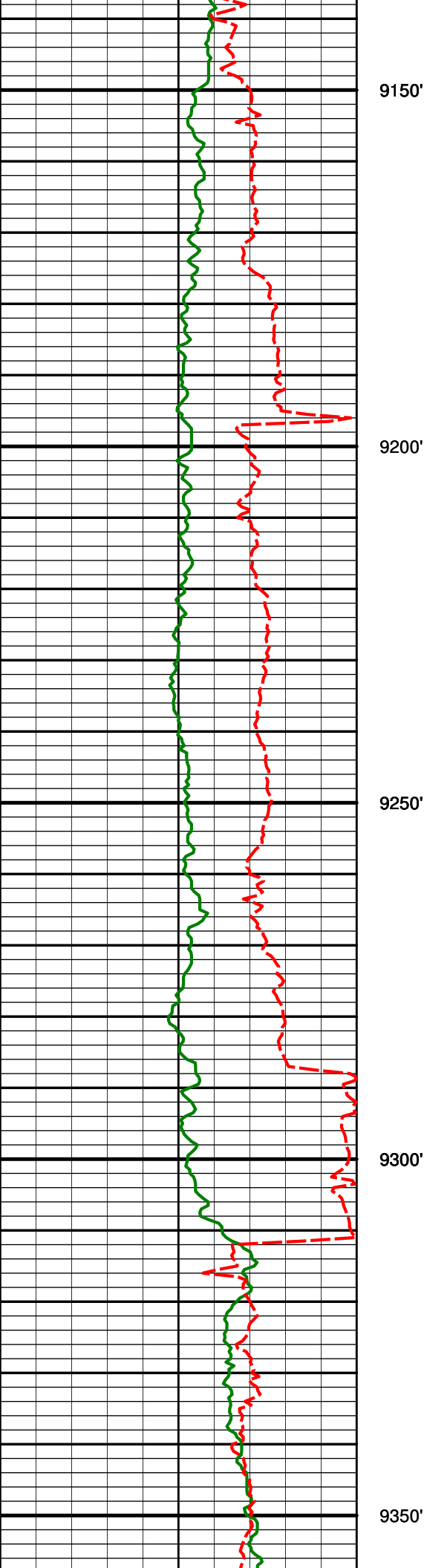
9127'

91.11°

90.64°

6015.26'

2988.24'



9150'

9200'

9250'

9300'

9350'

9222'

91.85°

91.19°

6012.80'

3082.81'

9317'

92.04°

89.15°

6009.58'

3177.45'



9400'

9412'

91.63°

88.92°

6006.54'

3272.24'

9450'

9500'

PGRC

ROPA

9507'

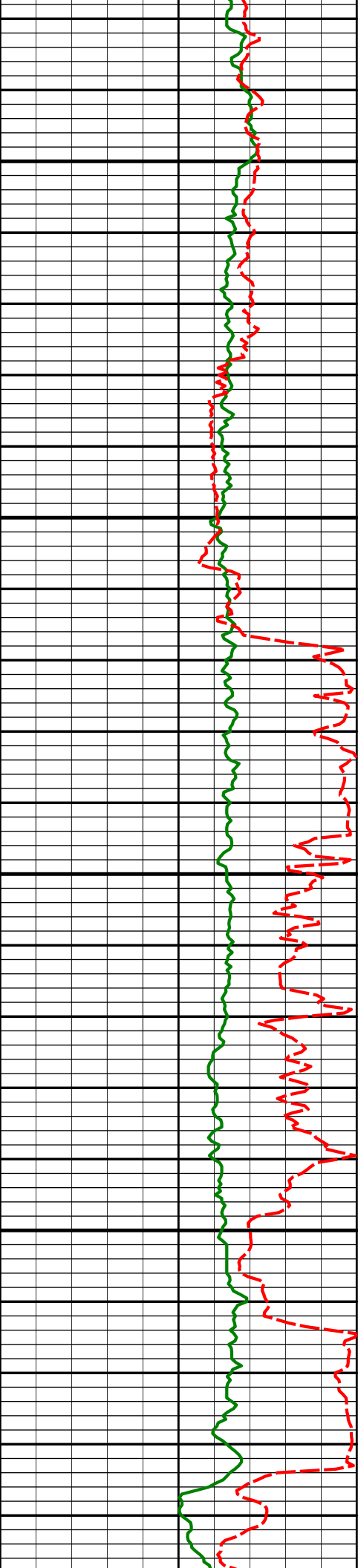
89.97°

87.12°

6005.21'

3367.14'

9550'



9600'

9602'

89.04°

85.95°

6006.03'

3462.12'

9650'

9700'

9696'

88.95°

87.21°

6007.68'

3556.10'

9750'

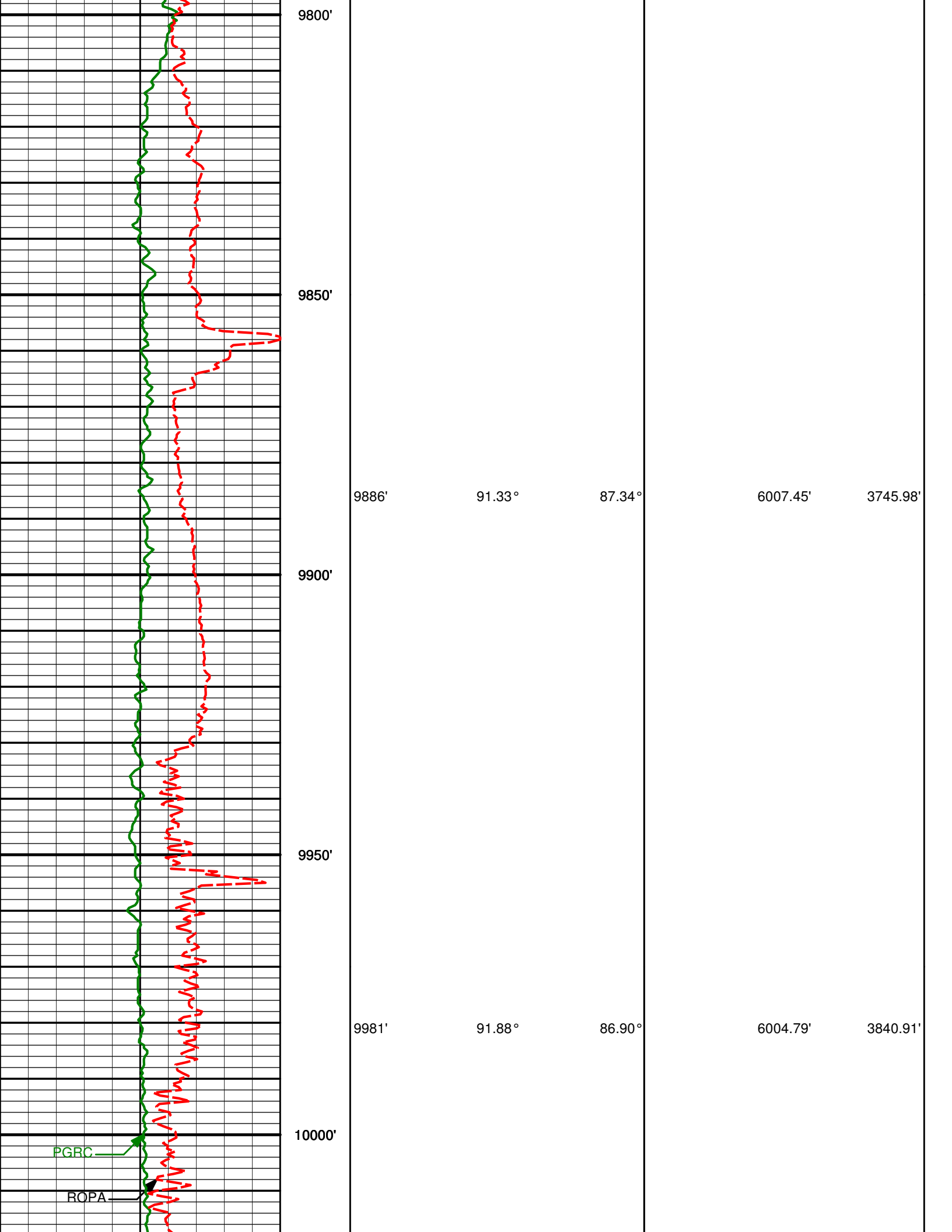
9791'

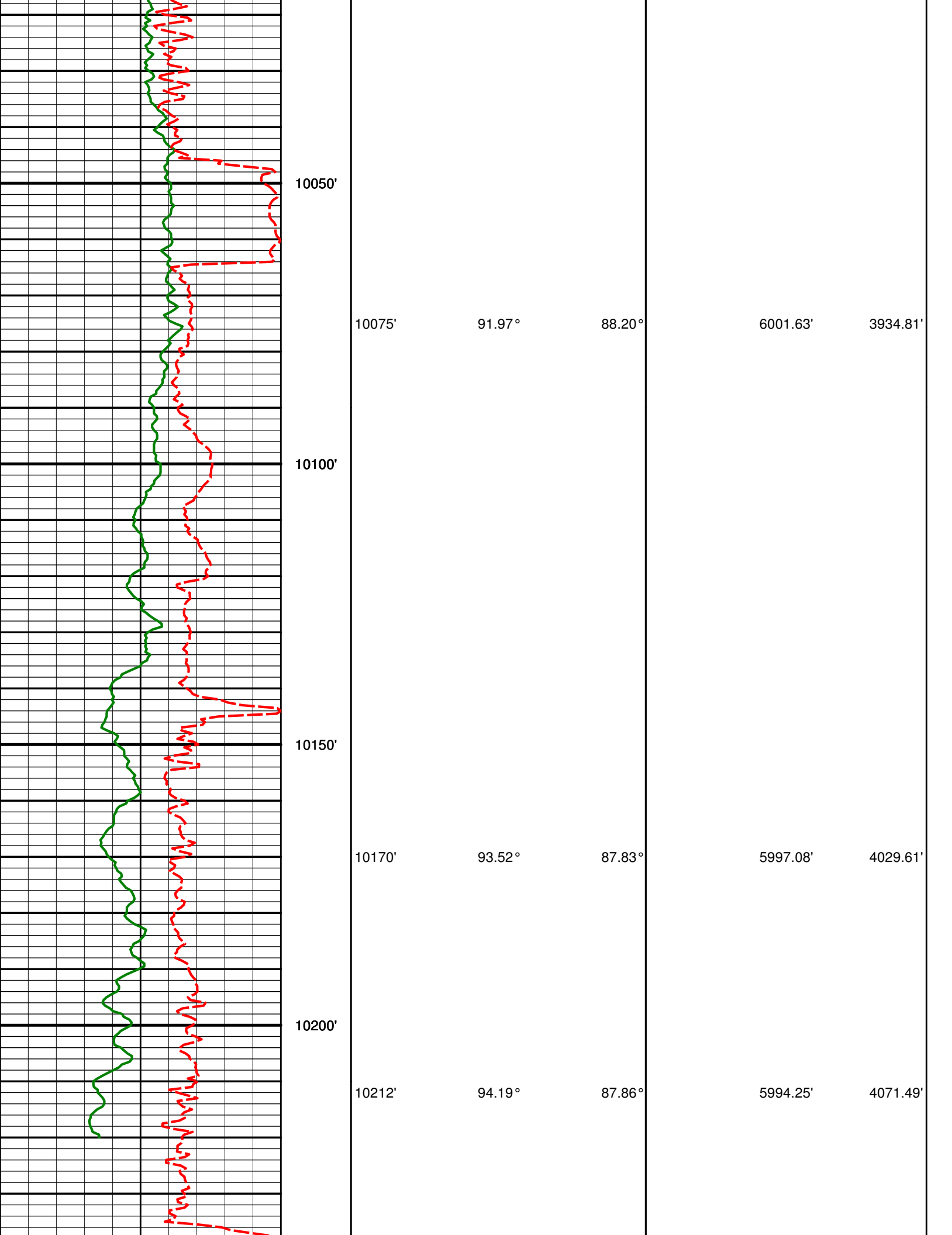
90.00°

87.75°

6008.55'

3651.04'







Measured Depth (feet)	Inclination (degrees)	Direction (degrees)	Vertical Depth (feet)	Latitude (feet)	Departure (feet)	Vertical Section (feet)	Dogleg (deg/100ft)
682.00	0.00	0.00	682.00	0.00 N	0.00 E	0.00	TIE-IN
729.00	0.94	5.09	729.00	0.38 N	0.03 E	0.06	2.00
1008.00	1.18	28.55	1007.95	5.18 N	1.61 E	1.99	0.18
1287.00	0.83	46.19	1286.91	9.09 N	4.43 E	5.10	0.17
1572.00	0.56	26.00	1571.89	11.76 N	6.52 E	7.39	0.13
1758.00	0.64	36.48	1757.88	13.41 N	7.54 E	8.53	0.08
1853.00	2.18	314.96	1852.85	15.11 N	6.58 E	7.70	2.29
1948.00	4.78	301.65	1947.67	18.46 N	1.93 E	3.32	2.86
2043.00	6.89	297.02	2042.17	23.13 N	6.52 W	-4.75	2.27
2138.00	8.86	286.73	2136.28	27.83 N	18.60 W	-16.44	2.54
2233.00	11.36	290.73	2229.80	33.25 N	34.36 W	-31.74	2.73
2328.00	13.45	293.12	2322.57	40.90 N	53.27 W	-50.02	2.27
2423.00	15.40	289.61	2414.58	49.47 N	75.32 W	-71.36	2.25
2518.00	14.93	286.65	2506.27	57.21 N	98.93 W	-94.31	0.95
2613.00	15.86	295.76	2597.87	66.36 N	122.34 W	-116.97	2.72
2708.00	15.96	299.29	2689.24	78.39 N	145.42 W	-139.08	1.02
2803.00	16.54	305.78	2780.45	92.69 N	167.79 W	-160.30	2.01
2898.00	16.48	306.15	2871.53	108.55 N	189.65 W	-180.89	0.12
2992.00	15.21	305.50	2961.96	123.57 N	210.45 W	-200.50	1.37
3087.00	12.26	300.52	3054.23	135.94 N	229.29 W	-218.35	3.34
3182.00	13.34	304.79	3146.87	147.31 N	246.99 W	-235.13	1.50
3277.00	11.43	304.85	3239.66	158.94 N	263.71 W	-250.93	2.00
3372.00	12.50	304.55	3332.59	170.15 N	279.91 W	-266.23	1.13
3467.00	14.31	298.06	3425.00	181.51 N	298.74 W	-284.15	2.48

3562.00	15.24	297.68	3516.86	192.84 N	320.16 W	-304.65	0.98
3657.00	16.02	298.96	3608.35	204.98 N	342.69 W	-326.19	0.90
3752.00	14.78	303.53	3699.94	218.03 N	364.26 W	-346.72	1.82
3846.00	12.14	308.54	3791.35	230.81 N	381.99 W	-363.43	3.07
3941.00	9.47	312.06	3884.66	242.28 N	395.61 W	-376.15	2.89
4036.00	4.83	310.86	3978.89	250.14 N	404.45 W	-384.36	4.89
4131.00	1.60	343.24	4073.74	254.03 N	407.86 W	-387.47	3.77
4416.00	1.90	51.81	4358.63	260.76 N	405.30 W	-384.40	0.70
4511.00	0.17	24.48	4453.61	261.86 N	404.00 W	-383.03	1.85
4796.00	1.42	316.33	4738.58	264.79 N	406.26 W	-385.06	0.48
4891.00	0.79	357.39	4833.56	266.29 N	407.10 W	-385.78	1.02
5176.00	0.85	41.52	5118.54	269.83 N	405.79 W	-384.21	0.22
5243.00	0.69	40.41	5185.53	270.51 N	405.20 W	-383.56	0.23
5358.00	1.59	70.72	5300.51	271.57 N	403.24 W	-381.53	0.91
5453.00	11.66	82.32	5394.76	273.29 N	392.46 W	-370.65	10.64
5500.00	15.13	81.93	5440.47	274.79 N	381.67 W	-359.79	7.39
5548.00	17.67	89.46	5486.52	275.74 N	368.18 W	-346.26	6.88
5644.00	25.76	92.28	5575.64	275.04 N	332.71 W	-310.95	8.50
5739.00	32.44	89.43	5658.60	274.48 N	286.55 W	-264.96	7.18
5786.00	35.09	88.13	5697.67	275.04 N	260.44 W	-238.88	5.85
5834.00	37.73	92.20	5736.30	274.93 N	231.97 W	-210.50	7.45
5929.00	47.29	93.84	5806.25	271.47 N	167.95 W	-146.92	10.14
5976.00	52.47	90.46	5836.54	270.16 N	132.05 W	-111.23	12.31
6024.00	56.27	87.94	5864.49	270.73 N	93.05 W	-72.30	9.00
6071.00	56.94	89.16	5890.36	271.72 N	53.83 W	-33.11	2.60
6119.00	59.95	88.91	5915.48	272.41 N	12.94 W	7.72	6.29
6166.00	62.54	89.90	5938.09	272.83 N	28.26 E	48.83	5.81
6214.00	65.75	87.30	5959.02	273.89 N	71.43 E	91.95	8.28
6261.00	70.73	86.79	5976.44	276.15 N	115.01 E	135.58	10.64
6309.00	75.76	86.63	5990.27	278.78 N	160.88 E	181.52	10.48
6356.00	77.89	87.81	6000.99	281.00 N	206.59 E	227.26	5.15
6387.00	81.16	88.41	6006.62	282.01 N	237.05 E	257.71	10.72
6469.00	86.30	87.55	6015.58	284.88 N	318.48 E	339.13	6.35
6564.00	86.33	89.00	6021.69	287.73 N	413.24 E	433.83	1.52
6659.00	87.29	90.36	6026.98	288.26 N	508.09 E	528.44	1.75
6753.00	88.70	90.35	6030.27	287.68 N	602.02 E	622.07	1.51
6848.00	90.46	90.62	6030.96	286.88 N	697.02 E	716.73	1.87
6943.00	89.48	90.29	6031.01	286.13 N	792.01 E	811.39	1.09
7038.00	89.63	90.06	6031.75	285.83 N	887.01 E	906.09	0.29
7133.00	91.26	90.18	6031.01	285.63 N	982.00 E	1000.80	1.73
7228.00	91.14	90.57	6029.02	285.01 N	1076.98 E	1095.46	0.43
7323.00	90.99	90.60	6027.26	284.04 N	1171.96 E	1190.09	0.17
7419.00	91.02	90.33	6025.58	283.27 N	1267.94 E	1285.74	0.28
7513.00	91.33	90.51	6023.66	282.59 N	1361.92 E	1379.40	0.38
7608.00	91.48	89.31	6021.33	282.74 N	1456.89 E	1474.10	1.27
7703.00	90.12	89.12	6020.00	284.04 N	1551.87 E	1568.91	1.44
7798.00	89.82	88.59	6020.05	285.94 N	1646.85 E	1663.76	0.65
7893.00	89.97	87.67	6020.23	289.04 N	1741.79 E	1758.67	0.98
7988.00	90.06	86.99	6020.21	293.47 N	1836.69 E	1853.63	0.73
8083.00	89.72	88.03	6020.38	297.60 N	1931.60 E	1948.58	1.15
8178.00	88.74	89.22	6021.66	299.89 N	2026.56 E	2043.44	1.63
8273.00	88.92	91.72	6023.61	299.11 N	2121.53 E	2138.08	2.64
8368.00	89.85	91.54	6024.63	296.41 N	2216.48 E	2232.56	0.99
8462.00	90.89	92.67	6024.02	292.95 N	2310.42 E	2325.96	1.64
8557.00	89.88	90.58	6023.38	290.25 N	2405.37 E	2420.44	2.45
8652.00	89.85	90.12	6023.61	289.68 N	2500.37 E	2515.12	0.49
8747.00	91.08	91.07	6022.85	288.70 N	2595.36 E	2609.76	1.64
8842.00	91.11	90.90	6021.03	287.06 N	2690.32 E	2704.33	0.18
8937.00	91.79	91.33	6018.63	285.21 N	2785.27 E	2798.87	0.84
9032.00	90.59	89.40	6016.66	284.60 N	2880.25 E	2893.52	2.40
9127.00	91.11	90.64	6015.26	284.57 N	2975.23 E	2988.24	1.42
9222.00	91.85	91.19	6012.80	283.05 N	3070.19 E	3082.81	0.97
9317.00	92.04	89.15	6009.58	282.77 N	3165.13 E	3177.45	2.15
9412.00	91.63	88.92	6006.54	284.37 N	3260.07 E	3272.24	0.49
9507.00	89.97	87.12	6005.21	287.66 N	3354.99 E	3367.14	2.58
9602.00	89.04	85.95	6006.03	293.40 N	3449.81 E	3462.12	1.57
9696.00	88.95	87.21	6007.68	299.00 N	3543.63 E	3556.10	1.34
9791.00	90.00	87.75	6008.55	303.17 N	3638.53 E	3651.04	1.25
9886.00	91.33	87.34	6007.45	307.24 N	3733.44 E	3745.98	1.46
9981.00	91.88	86.90	6004.79	312.01 N	3828.28 E	3840.91	0.75
10075.00	91.97	88.20	6001.63	316.03 N	3922.14 E	3934.81	1.39

<b>10170.00</b>	<b>93.52</b>	<b>87.83</b>	<b>5997.08</b>	<b>319.32 N</b>	<b>4016.97 E</b>	<b>4029.61</b>	<b>1.67</b>
<b>10212.00</b>	<b>94.19</b>	<b>87.86</b>	<b>5994.25</b>	<b>320.89 N</b>	<b>4058.84 E</b>	<b>4071.49</b>	<b>1.61</b>
<b>10278.00</b>	<b>94.19</b>	<b>87.86</b>	<b>5989.43</b>	<b>323.35 N</b>	<b>4124.62 E</b>	<b>4137.26</b>	<b>0.00</b>

**CALCULATION BASED ON MINIMUM CURVATURE METHOD**

**SURVEY COORDINATES RELATIVE TO WELL SYSTEM REFERENCE POINT  
TVD VALUES GIVEN RELATIVE TO DRILLING MEASUREMENT POINT**

**VERTICAL SECTION RELATIVE TO WELL HEAD  
VERTICAL SECTION IS COMPUTED ALONG A DIRECTION OF 85.66 DEGREES (GRID)  
A TOTAL CORRECTION OF 7.29 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED**

**HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.  
HORIZONTAL DISPLACEMENT(CLOSURE) AT 10278.00 FEET  
IS 4137.28 FEET ALONG 85.52 DEGREES (GRID)**

**Date Printed:20 January 2013**